Computers for the Bovine Practitioner

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Recent years have evidenced a boom in the computer industry such that computerization has touched the lives of nearly everyone. Microtechnology has made microcomputers affordable to many individuals and businesses (costs from a few hundred to a few thousand dollars). The challenge to the bovine practitioner is to take the technology and put it in a usable form. This challenge means finding a way to convert microcomputer potential into improved practice efficiency and/or quality.

Basically, What Do Computers Do?

In a very simplified form computer uses and capabilities can be classified into four major categories:

1. They store information. In computer language this information is usually referred to as data. This storage of information is really nothing new and the input is often no more complicated than would be typing the information on a typewriter. The primary reason for information storage is to allow the computer to use this information in the other three categories.
2. The computer possesses a tremendous ability to manipulate this information or data. Some examples of why this might be useful in bovine medicine include the following:
   A. When useful information is camouflaged within a great deal of data. For example, suppose one wanted to evaluate the incidence of cystic ovaries in all the herds for which herd health programs were being carried out. In addition, one wanted to know the average and range of times it took for these cows to manifest estrus, the time post partum these occured, the fertility of subsequent breedings and the percent of these cows that became pregnant within 150 days post partum. The computer could process a huge amount of data and if properly keyed select and summarize this information.
   B. When the data base is large and needs organizing. An example would be to ask the computer to print a list of all cows which will be examined during a reproductive herd health exam including fresh dates, most recent milk weights, breeding dates, the number of the breeding, findings for other examinations of this lactation, treatments done, etc.
   C. When manipulations of information or data are burdensome. For example, to balance a ration for a milking herd for 20 nutrients using the cheapest purchased feeds.
   D. To provide rapid access or an organized presentation of information. For example, for use in research, teaching, assisted diagnosis, etc.
3. Computers drive other devices to do routine tasks. Examples might be the printing of bills in an accounting program, the preparation of practice newsletters, the collection and recording of milk weights, computerized feeding programs wherein grain is automatically fed according to milk production.
4. Computers are sometimes used to provide for data transfer between users or between programs. Very often telephone lines are used to accomplish this purpose.

Hardware

Hardware is the name given to the tangible parts of the computer. It involves the basic computer itself, as well as a series of what are called peripherals which increase the functional capability of the computer, (but which are not integral to the workings of the computer itself).

At the center of the basic computer is the central processing unit. The central processing unit is the brain of the computer and all actions that the computer performs are processed through the central processing unit.

Another very integral part of the computer is the memory. The memory consists of a series of chips which allow the recording of information. All of the information recorded in the memory is electrical, so that if the computer is turned off, everything is lost from one portion of the memory, which is called the Random Access Memory, often abbreviated as RAM. Another portion of the memory called the Read Only Memory (ROM) has a set of instructions which are necessary to the function of the computer. The set of instructions contained in the read only memory is referred to as the operating system, or because a disk drive is so often used, it is commonly referred to as the disk operating system, or DOS. More will be said about DOS under a discussion of software.

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In order for the computer to perform a useful function, it must have devices which are used to input data or information. Many devices are capable of this, however the two most commonly used in micro-computers are the keyboard and the disk drive.

The keyboard of a computer is very similar to a typewriter in that it contains letters and numbers in essentially the same positions that these exist on a typewriter keyboard. Depending on the particular computer, there are a number of other keys which facilitate sending commands to the computer or accomplishing other functions.

The disk drive is both an input and output device which allows for the more permanent storage of data and for the rapid transfer of information to and from a disk. Floppy disks are most commonly used and are 5¼" in diameter. These disks are protected within a plastic jacket and store information on a magnetic oxide base, very similar to the process used for tape recorders. Indeed tape recorders have been used as input devices for microcomputers, however the disk provides a greatly increased ability for accessing only the information desired in a very rapid and efficient manner. Many computers now use more than one disk drive to facilitate even more the transfer of information. A device called a hard disk may be used and has much greater storage capacity, safety against accidental data loss and cost.

Of course for the computer to be useful, it must also have a manner to transfer information back to the user. The most often used device is the cathode-ray tube, (abbreviated CRT) also called a monitor or screen. A television screen is the basic part of the cathode-ray tube, and indeed a TV set can be used to perform this function. However, to increase the sharpness of printed images and to allow other functions, special CRT's or monitors are very commonly used with computers.

A list of computer peripherals would be very extensive, however some of the most commonly used are worthy of mention. A printer allows the data which is output by the computer to be recorded in a more permanent and usable fashion. Data printed by the computer may be referred to as "hard copy" to distinguish it from data stored on disks called "soft copy." The most commonly used printers are termed dot-matrix printers and all letters or images that they print are composed of a series of dots. Dot-matrix printers are considerably cheaper than letter quality printers which produce images equivalent to those produced by a typewriter.

A micromodem is a peripheral which allows for the telephone transfer of information from one computer to the other. The most commonly used ones simply allow the plug in of a telephone jack and the micromodem then is directed by the computer to perform such functions as dialing the telephone number, transferring information from the computer over the telephone line in a manner which can be intercepted and understood by the device on the other end of the telephone line, and the termination of the telephone session. Many other sophisticated peripherals exist which allow for the collection of research data from scientific devices. Computerized milk measuring devices, and computerized feeders would also be classified as computer peripherals.

Software

Software is basically a set of instructions which make the computer system, including the central processing unit, the memory, the disk drive and the monitor or screen function in a coordinated manner. Software is the most critical component of any computer system. With proper software the machine can rapidly and accurately perform a wide variety of useful or entertaining tasks. The tasks may be as simple as printing a short message on the screen, or it may involve millions of mathematical operations. Without software the computer is completely inanimate and is incapable of performing any task. Software bridges the gap between the user and the central processing unit.

The three general types of software which are involved in virtually all computer operations are:

1. Operating systems, often called disk operating systems or DOS.
2. Application programs, very often when one refers simply to software or programs application programs are those being referred to.
3. Programming languages.

Each of these will be described briefly.

Operating Systems

The operating system is a program that controls the internal functions of the computer. It acts as an interface between the user, the CPU, and the other parts of the computer system. It translates instructions from the operator into electronic signals that the CPU understands and reacts to, and translates signals from the CPU into a language that can be understood by the operator. For example, when the user depresses the "a" key, the CPU understands that the letter "a" has been entered, rather than some other character, because the operating system provides the information for the CPU to interpret the electronic signal that was generated at the keyboard. The operating system also controls all the peripheral equipment such as the screen, the disk drive, and the printers.

The operating system is very important to a successful computer operation. A good system makes the machine flexible and easy to use. Many microcomputers come equipped with a disk operating system as part of the hardware. This is an important consideration since the disk operating system present will determine the types of application programs or software which will successfully function in a given computer. There now exist several disk operating systems and families of computers are classified by the similarity of their disk operating systems. For example, when one says that a computer is IBM compatible, this means that the same disk operating system is used in this

machine as the one which is used in the IBM series of computers. Many microcomputers may be operated with other disk operating systems, however this generally involves some manipulations and/or additional hardware (chips or cords) which are sometimes complicated and may limit the ease with which application programs may be run.

Applications Programs

Applications programs let the computer perform specific functions. Application software consists of a set of instructions or commands. The program may perform a simple task such as determining the efficiency of a vehicle in miles per gallon, or it may perform a complex task, such as the calculation of complicated statistical packages as in the calculation of bull sire summaries.

Applications programs run under the control of the operating system. In addition, the proper computer language package must be available. If the computer, the operating system, computer language, and the applications program are compatible, (that is able to work together), the applications program can usually be used successfully. There are, however, other considerations such as the amount of memory available, the type of external storage, availability of peripheral such as the printer or micromodem which also must be satisfied.

Applications programs may be procured from many sources, including computer dealers, software companies, and educational institutions. Depending on the source, a particular program may be free or may cost up to several thousand dollars. The cost for a typical program is usually in the $25-500 range, although complicated practice management programs often cost several thousand dollars. Many computer owners have as much money invested in the various applications programs, as they have in the computer hardware.

Programming Language Software

Programming language software is a program that translates the applications program instructions into a form that the computer can understand. Computer languages, like other languages, are composed of selected words and rules for assembling the words into a statement. There are many languages available for most computers. Frequently, one or more are supplied with the computer as part of the original purchase package. If a computer user is interested in creating his own programs (programming), he must learn one of these computer programming languages. Such languages as BASIC and Pascal are programs that use English words and statement structure which are relatively easy for most people to learn and understand.

Programs of Interest to Bovine Practitioners

Herd Management Programs:

These programs basically do three important things, although some perform a fourth function as well:

- They allow for data storage. This data storage may include a large variety of data, but such things as freshening, movements to production groups, milk weights, vaccination dates, treatments, palpation findings, disease occurrences, etc. are the most common data input. Of course the storage of this data is done only as a necessity for the other functions of the program. The most useful herd management programs allow some sort of interaction with Dairy Herd Improvement Association programs. Since DHIA records are already computerized, much of the information which will be useful for the integration with herd health information is already recorded in the DHIA computer. Therefore, some DHIA processing centers have developed herd management programs which allow access by way of a computer terminal or microcomputer using a micromodem. Since the input of data is a relatively time consuming and expensive process, the ability to either use the DHIA records or input (may be termed "download") the DHIA records into the herd management program is almost a must.
- These programs present, organize, and sort information to improve decision making ability. In other words, the programs provide for a data analysis that would be impractical on a manual basis. Hence, such things as a complete analysis of treatment outcomes, computation of the incidence of certain disease problems, or more sophisticated analysis of data for the diagnosis of problems resulting in production losses may be performed. In addition, some programs contain planning options that include such capabilities as projected herd inventories, milk production projections, etc.
- Most herd management programs provide for the sorting of information so as to generate lists that facilitate herd management and inventory control. Examples of such a report would be a reproductive check list, list of dry cows, heat expectancy list, production grouping list, list of cows that have been treated for mastitis, or a list of cows which have been culled for a given reason. A specific category of lists which programs may generate are called Action Lists, similar to the action lists which are created by DHIA and include such things as cows to be put in pre-calving conditioning programs, calves to vaccinate, etc.
- Some programs may also provide education or other information services. The DHIA herd management program DART (direct access to records by telephone), for example, provides such programs as a max-bull program which aids in the selection of bulls to be used in a breeding herd and provides bull-proof summaries.

Nutrition Programs

Nutrition computer programs have greatly facilitated the

balancing of rations in applied nutrition, and indeed constitute the reason for the purchase of computers by many bovine practitioners.

Most of these nutrition programs are essentially ration balancers that contain a set of simultaneous equations which calculate the feed stuff amounts needed to provide a ration balance for nutrients. In order for these programs to function, the user must first provide: a) Data on feed-stuffs available and their nutrient analysis. Some programs contain a library of feed-stuffs with NRC values which may be used or revised by the user if feed analysis data is available. b) Information on a cow or herd of cows to which the ration will be fed. Such information as body weight, milk production, milk fat percent, percent of heifers in the herd, stage of lactation, etc. c) Restrictions. The use of restrictions in the ration balancing program allow the user to include maximum and/or minimum limitations on feed-stuff amounts, nutrient requirements, or other constraints on the ration.

Many computer programs also contain an economic component. Least cost programs provide for the input of feed-stuff or ingredient costs, and therefore allow the computer to select the ration combination which will be most economical, as well as meeting the nutritional needs. These least cost programs will often also provide opportunity costs which essentially are the feed-stuff costs at which their inclusion in the ration might be considered. These least cost rations tend to be very useful if one is in a situation where many choices are available. They may simply increase the complexity and frustration in successfully balancing rations if few feed-stuff options are available.

Some recently developed ration balancing programs involve spread sheet options. The Dairy 4 program created by the Dairy Science Department at Virginia Tech is one example. These ration balancing programs provide for the balancing of a ration, essentially by trial and error method. However, the computer does the calculation so much more rapidly than hand calculations could be done that the process can proceed rapidly and allows the user to visualize more of what is actually being done in the ration balancing than the more sophisticated methods.

Practice Management Programs

Perhaps the largest incentive for computerization in veterinary medicine has been the use of practice management programs. The original programs handled only basic accounting tasks. With increased sophistication, those accounting programs provided for an increase in the sophistication and ability of business management in the veterinary practice. One owner, for example, claimed that the ability to use finance charges provided by the use of a practice management program paid for the entire computerization process. Some practice management programs now contain some very elaborate functions. Examples would be:

- medical records creation and maintenance
- preventive medicine notices, for example, owners can be routinely sent vaccination, worming, or other notices automatically by the computer
- automated pricing options which automatically update prices for drugs as veterinarian prices increase or decrease
- inventory control which greatly facilitates the ordering of drugs and supplies
- practice management analysis which provides for such options as income generated by individual partners within a practice, income generated by various segments of the practice, the profitability of various practice components, income for all, etc.
- a readily accessible list of clients. These lists may be categorized in any number of fashions
- computer aided practice newsletter creation. Some programs contain as many as 100 pre-written paragraphs which may be selected from or revised to readily create a practice newsletter.
- creation of spay/neuter, vaccination certificates
- creation of special practice reports
- multi-user capabilities. In other words, some practice management programs allow for computer stations at several different points, managed by one central computer.
- scheduling programs which provide for appointment scheduling, etc.

Word Processing Programs

Word processing programs provide for the creation of printed material, first in the microcomputer memory, with hard-copy (that is written on paper) printing later. This allows for liberal manipulation of the text prior to the final printing process. Hence, one may make corrections, deletions, reorder parts of the documents, revise the format, correct spelling and punctuation errors, and then finally print as many identical documents as are needed.

If using the computer as a word processor is a major priority, the quality of the printer becomes very important. Some dot-matrix printers provide written quality which may be unacceptable for things such as client newsletters, correspondence or other communications.

Inter-computer Communications

A micromodem, (which uses a telephone line) or other computer line may allow access to many other computers. This might be useful for such options as:

- Access to other computer programs. The DART program gives access to DHIA records
- Communications with other veterinarians. This option is referred to as networking and allows a group of users who are involved in a network to leave messages which may be retrieved at any time by other users.
- Information systems. Many information systems have

been created and allow a computer user to perform such functions as literature searches, or utilization of comprehensive information systems which provide the user with information varying from up-to-date weather reports to current financial reports.

- Business by computer. Such options as home banking and computer shopping, may be performed by inter-computer communications.
- Interactive video functions are also available in some instances which allow users to have access to continuing education or other visual material by way of a personal microcomputer.

Programs for Special Needs or Uses

These needs or uses are best demonstrated by a couple of examples. Dr. John Fetrow at North Carolina State University has recently created and published a program which involves the evaluation of the economic benefit of prostaglandin uses in dairy reproductive programs. This program points out that the monetary return to owners when prostaglandin is used will depend upon such factors as heat detection, days post-partum, conception rate, etc. This program therefore allows one to input these factors for a given dairy and then calculate the expected benefits that would occur from prostaglandin usage for each of several usage programs.

One specific kind of computer program which is widely used is termed a spread sheet. Spread sheets can be used to perform an almost unending variety of functions. Included figures 1 and 2 demonstrate two programs created by Dr. John Kirk.[1] These demonstrate the usefulness of spread sheets in food animal medicine when these spread sheet programs are tailored to specific uses.

The limits on programs which could be created and which would provide benefit to bovine practitioners is only limited by a lack of computer programmers to produce such software and by a lack of bovine practitioners' imagination in requesting or becoming involved in such programs.

Computer Aided Diagnosis

Computer aided diagnosis has been a subject of considerable interest both in human and veterinary medicine for some time. As hardware and software capabilities have increased, the ability of computers to aid or diagnose disease is a subject of considerable interest and of some practical use at this point. Programs available in veterinary medicine vary considerably as to their specificity and complexity.

One computer aided diagnostic program called PROVIDES has been produced by Cornell University. When the computer is supplied with a given list of clinical signs or laboratory findings, it responds with potential conditions. The user may then address short reviews of the conditions and find references where further information on these diseases may be obtained.

Other programs which would be useful to bovine practitioners are somewhat more limited in scope. For example, a computer program is available which provides for hemogram analysis. When the results of a complete blood count are entered, the program then suggests diseases which would be compatible with this and provide some guidance as to the strength of the association with each of these conditions. Programs for analyses of blood chemistry profiles are also available. A cardiology program is available which allows the microcomputer to evaluate an ECG and suggest causes of ECG abnormalities.

Suggestions, Commandments, Ideas

As a summary to this presentation on microcomputers and their usefulness to the bovine practitioners, I leave some ideas and thoughts that have been gained by my experience with computers in the field of bovine veterinary medicine.

1. *This is essentially a commandent.* So many of the failures in attempts to use the microcomputer have been created by ignoring this rule that deals with entry into microcomputerland. Four steps should be followed before one considers computerizing, and the order in which these steps are taken is cardinal.

   First, one should decide what he wants computers to accomplish for himself. Without a strong commitment to make computers change or improve the way you do something you'll probably become discouraged before the task is accomplished.

   Second, the software which will accomplish this task should be selected.

   Third, the hardware which is compatible with the software should be selected. The order of these first three steps is very important. All too often hardware dealers have sold veterinarians computers with the promise that software would shortly be available to accomplish given tasks. When the software does not become available, the computer may have little use. Therefore, the software should first be selected and tried, and the hardware secondarily purchased.

   Fourth, select a vender which will provide service. Many microcomputer systems seem to be quite tempermental and without the ability to have rapid and effective service, considerable frustration if not disastrous economic results may occur.
2. *A suggestion.* Much good software will be available in several DOS options. The more popular DOS options, in other words, computers which use DOS systems compatible with the more popular computers will allow greater potential for compatibility when one considers the purchase of additional software.

From John H. Kirk; Electronic s=Spread Sheets in Veterinary Medicine. Computer Veterinary Update. 1985; 1(4):6, 7, 14-16.

3. *Don't expect computers to decrease your time investment spent on records.* The more common experience when one computerizes is that record keeping time requirements actually increase slightly, or in some instances considerably. In return for this input useful information and management options increase.

Abstracts

Day of embryo collection, quality and pregnancy rates in cattle

L. E. Donaldson

Veterinary Record (1986) **118**, 661-663

In 1300 donor cows, total embryos increased from 8·5 to 15·3, ($P < 0·001$), the mean number of transferable embryos from 3·1 to 6·5 ($P = 0·067$) and pregnancies increased from 1·3 to 3·3 ($P = 0·584$) as the day of collection increased from six to 7·5. Most of the embryos recovered on day 6, 7·5 and 8 were morulae, early blastocysts and late blastocysts respectively. Morulae formed the majority of the embryos collected on days 6 and 6·5. Pregnancy rates in early and late blastocysts were highest on days 7 (54·4 and 60·2 per cent) and 7·5 (53·6 and 53·1 per cent, $P = 0·009$ and $0·004$). There were significant differences in pregnancy rates between embryo stages on days 7 and 7·5 ($P < 0·001$), embryo grades on days 7, 7·5 and 8 ($P < 0·001$), and within embryo grades 1 ($P = 0·015$) and 3 and 4 (pooled, $P = 0·009$). On all days combined there were significant differences in pregnancy rates between both embryo stages ($P = 0·007$) and embryo grades ($P < 0·001$). It appears that the concept of embryo fitness may be applied to blastocysts but not to morulae.

Microbial flora of the eyes of cattle

D. M. L. Barber, G. E. Jones, A. Wood

Veterinary Record (1986) **118**, 204-206

The bacteria and mycoplasma occurring in the eyes of normal healthy calves were monitored in three groups of animals from purchase at about one week old to slaughter at about 15 months old. Non-haemolytic *Moraxella bovis*, *Branhamella catarrhalis* and *Mycoplasma bovoculi* were all isolated regularly, though their seasonal occurrence varied. The significance of these findings with respect to infectious bovine keratoconjunctivitis is discussed.

Regulation of ovarian function in the post partum cow: An endocrine model

A.R. Peters, G.E. Lamming

Veterinary Record (1986) **118**, 236-239

Recent studies of endocrine function during the period after parturition are discussed and used as a basis for the development of a hypothetical model for the control of ovarian function in the cow after calving. It is postulated that the main sequence of endocrine changes is as follows. At first gonadotrophin releasing hormone is secreted infrequently in small quantities. Very early after parturition the secretion of follicle stimulating hormone increases, thus stimulating the development of follicles. There is then a gradual increase in responsiveness to gonadotrophin releasing hormone which results in an increased frequency of release of pulses of luteinising hormone. Follicular growth results in the production of oestradiol and inhibin. Finally there is a gradual restoration of the positive feedback mechanism by which preovulatory gonadotrophin release occurs. In a normal cow the whole process appears to be complete by approximately two weeks after parturition.

Cavernosography and differential diagnosis of impotence in the bull

C.E. Glossop, R.R. Ashdown

Veterinary Record (1986) **118**, 357-360

A new indirect radiographic technique is described for the differential diagnosis of erectile impotence in the bull. Two cases of impotence have been investigated in this way. In the first, occlusion of the dorsal longitudinal canal of the corpus cavernosum penis in an 18-month-old Hereford bull was diagnosed. In the second, distal venous drainage of the corpus cavernosum penis was demonstrated in a five-year-old Hereford bull. Post mortem examination of the reproductive tract confirmed the diagnosis in each case.